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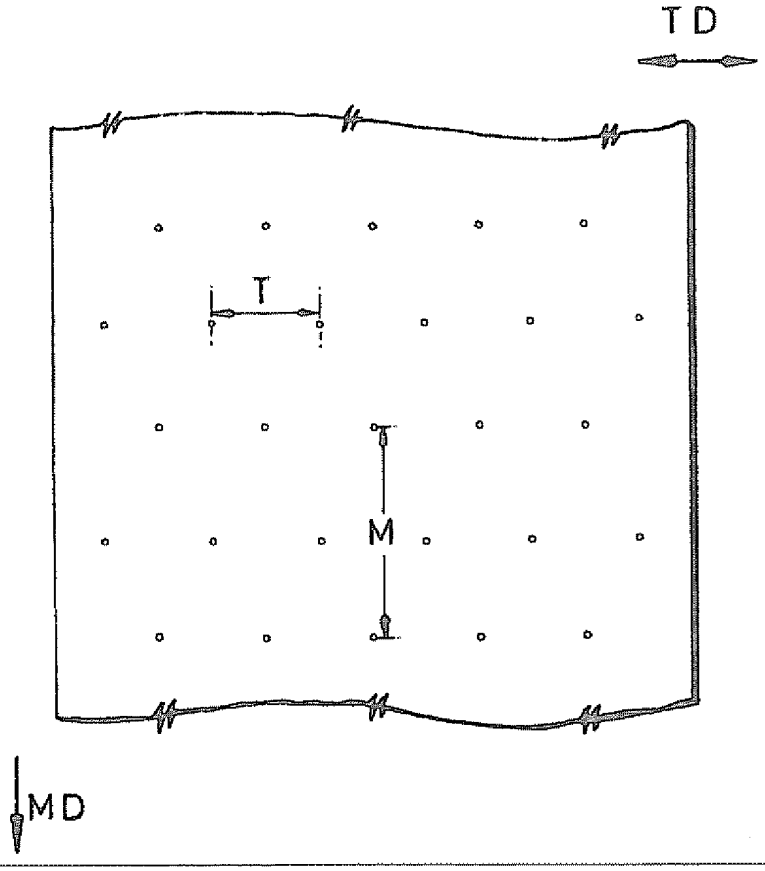
(54) Title: COLLAGEN FILM

(57) Abstract

A perforated collagen film is utilised for wrapping meat and poultry food products. The film comprises a series of perforations for allowing the escape of trapped air or steam from within the wrapped product, the pattern and the spacing of the perforations in each of two mutually perpendicular directions (T, M) and the size of each perforation being such that the film has a strength sufficient for wrapping, processing and cooking a compressed netted food product without tearing of the film.



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COLLAGEN FILM

FIELD OF THE INVENTION

The present invention relates to collagen film for wrapping meat and poultry food products, and to a method of wrapping such products.

BACKGROUND OF THE INVENTION

It is known in the food industry to package meat and poultry joints, particularly ham, in a compact form in a net prior to cooking. The net serves to hold together the pieces of meat or poultry and provides a solid carveable netted product of good appearance. It is also conventional to interpose a layer of collagen film, between the meat or poultry joints and the outer elastic net whose purpose is to prevent damage to the meat surface, to reduce loss of juices during cooking, and to improve the external appearance of the netted product. Such collagen films are widely available, for example from Devro Ltd. Normally, the collagen film is provided in a continuous length of widths typically 400mm, 480mm and 580mm and typically has a thickness in the range 0.015 to 0.035mm. As typified in US Patents Nos. 4,910,034 and 4,958,477, the disclosures of which are incorporated herein by reference, pieces of meat are compressed within a cylindrical guide, around which is fed the flat film, which is overlapped into a tubular configuration. An elastic netting is provided around the outside of the collagen film tube. As the compacted meat or poultry pieces are delivered from the guide tube, they are wrapped in the collagen tube and the net pulled over the collagen layer. The netting is then crimped at either end of the meat so as to form a generally ovoid netted product. The product is then cooked. The process is particularly applicable for the production of netted cooked hams. Collagen film is a material of not particularly high tear strength, particularly when wet or in contact with

moist meat or poultry. Because of its proteinacious nature, cooking has the effect of bonding the collagen film to the meat or poultry to form a unified product.

One problem which is encountered in the process described above, is that air or steam may become trapped under the collagen film, either during wrapping as described above or during subsequent cooking. This gives rise to unsightly air pockets which detract from the appearance of the product. To counteract this the filled netted product may be punctured manually, or "tacked" by rolling the netted product over a spike or tack board. However, since the meat or poultry is compressed, puncturing the film in this way risks splitting the collagen film, which is not intrinsically particularly strong. This risk is heightened by the practice of plumping the filled netted product to improve its shape prior to cooking. During plumping, the product is compressed longitudinally to make the ovoid shape round; which increases the hoop stress on the collagen film.

It is an object of the present invention to mitigate these problems.

SUMMARY OF THE INVENTION

One aspect of the present invention provides a perforated collagen film for wrapping meat and poultry food products, the film comprising a series of perforations for allowing the escape of trapped air or steam from within the wrapped product, the pattern and the spacing of the perforations in each of two mutually perpendicular directions and the size of each perforation being such that the film has a strength sufficient for wrapping, processing and cooking the compressed netted food product.

According to another aspect of the present invention there is provided a method of wrapping a meat or poultry product, the method comprising the steps:

providing a perforated collagen film, the degree of perforation of the film being selected to allow passage of

air therethrough, but not so as to compromise the strength of the film; and

wrapping the film around a meat or poultry product, any air trapped between said film and said product escaping through the film perforations.

Preferably, the film-wrapped product is subsequently wrapped in an elastic net.

According to a further aspect of the present invention there is provided a method of producing collagen film for use in wrapping meat and poultry products, the method comprising the steps:

providing a collagen gel;

extruding a film from the gel onto a surface;

drying the extruded film; and

perforating the dried film such that, in use, the film will allow escape of air from between the film and a meat or poultry product wrapped therein, and the strength of the film is maintained at a level sufficient to allow wrapping, processing and cooling of the food product without tearing.

The gel from which the film is extruded is typically acidic, to provide swelling of the gel. The film may be utilised in the acidic condition or may be neutralised, for example by passing ammonia over the dried film. The perforation step will typically be carried out following the neutralising step.

Another aspect of the invention relates to the cooked or uncooked filled netted product having a perforated collagen film wrapping.

It has been found that the perforations may be produced conveniently using needles. The needles may be mounted radially in a drum provided with a cam arrangement to extend the needles as the drum is rotated at the same speed as the dried film to be perforated. Surprisingly, it has been found that round needles having square-cut ends produce holes with clean edges; ragged edges are undesirable as the possibility of tear propagation from the hole edges would be likely to significantly reduce the film

strength. Perforation may be carried out using a punch and die arrangement, but alignment of the punch and die during production may give rise to production difficulties. It has been found that using a laser beam to produce a perforation gives particularly good results, since the periphery of the hole is smooth and moreover may be reinforced by some melting of the collagen material. Sparking may provide similar advantages. The perforations are preferably circular or generally oval in shape.

It has been found that larger perforations tend to reduce the strength of the collagen film to an unacceptable level. As well as reducing the strength, larger holes tend to release too much liquid during cooking and thereby lead to unacceptable weight loss in the cooked product. Preferably, the perforations have a diameter (or minor axis in the case of oval perforations) less than 0.9mm, preferably less than 0.7mm, most preferably 0.5mm or less. In order to provide efficient release of trapped air, a practical lower size limit is 0.1mm, preferably at least 0.2mm.

Generally speaking, the perforations should be arranged in a pattern which maximises the distance between adjacent perforations. The perforations may be arranged in a random pattern (provided that a lower limit for the spacing between adjacent perforations is observed), or a square pattern. Preferably, a diamond pattern is employed in which the holes in adjacent rows are staggered with respect to each other. The spacing between adjacent holes may be the same or different in the longitudinal or transverse directions. Preferably, each perforation is spaced 20 to 100mm from its closest neighbour. In a preferred embodiment, the holes are spaced 30 to 90mm apart in the longitudinal direction and 16 to 60mm apart in the transverse direction. Preferably also, the holes are spaced from the edge of the film, to minimise the possibility of tear propagation from the holes.

The film thickness is preferably between 0.017 and

0.028mm (0.70 - 1.10 thou). The most preferred hole pattern for each particular application will depend on the characteristics of the film and the stress the film will experience during the wrapping operation, for example: certain film extrusion processes produce film having greater strength in the longitudinal machine direction than in the transverse direction; and during the wrapping operation the hoop stresses experienced by the film may be greater than the longitudinal stresses (using the apparatus described in US Patent No. 4,958,477 the maximum stress would likely be experienced transversely of the film).

Usually, the perforations are arranged such that the strength of the collagen film is reduced by not more than 30%, preferably 20%, more preferably 10% and ideally 5% of its strength in a specified direction.

Embodiments of the present invention will now be described by way of example only.

BRIEF DESCRIPTION OF THE DRAWING

The Figure shows schematically a collagen film according to the invention having perforations arranged in a diamond pattern. For the purpose of illustration, the film is of a reduced width compared to conventional widths.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

EXAMPLE 1 (punched holes)

An acid collagen film (type 60/61 available from Devro Ltd., Bellshill, UK and having a thickness of about 0.022mm) was perforated with 0.5 and 1.0mm holes by punching using a punch and die. Dumb-bell shaped pieces

of film (total length 71m, width 12mm, with circular end portions of 19mm diameter each) were cut from the film in both the machine direction (MD) and transverse direction (TD) relative to the direction of extrusion and production in a conventional film forming machine. Holes were then punched in the centre of the dumb-bell in the case of a single perforation; and in the case of two perforations these were spaced 25-30mm apart symmetrically along the central rectangular portion.

The enlarged end portions of the dumb-bell shaped pieces were clamped in the jaws of an Instron 1112 machine. Water was then sprayed onto the pieces to simulate the conditions the film experiences in use. The jaws were then moved apart at 50 mm/min and readings taken to establish the modulus (kg/mm) of the samples, a higher modulus signifying a stiffer sample and a lower modulus signifying a more elastic sample.

The results are shown in Table 1.

The results indicated that the sample with the 0.5mm hole retained acceptable properties, however the decrease in modulus (27%) the transverse direction of the sample with the 1mm hole is approaching an unacceptable level.

EXAMPLE 2 (laser cut holes)

A neutralised acid collagen film (Devro Ltd.) was perforated with 0.5mm diameter holes in a diamond pattern (see Figure 1). The spacing M between holes in the machine direction (MD) was 60mm and the spacing T in the transverse direction (TD) was 30mm. The holes were perforated using a laser beam.

The MD and TD strengths were measured by cutting out dumb-bell shaped pieces of film, as in Example 1, which included one or two holes and testing the pieces in a Instron 1112 machine. The results are given in Table 2.

TABLE 1

Film	Modulus	Percentage MD	Percentage TD
A) Unperforated (comparison)	MD 1.46 (± 0.14)	100	
	TD 1.00 (± 0.16)		100
One 1mm hole	MD 1.37 (± 0.17)	94	
	TD 0.73 (± 0.13)		73
One 0.5mm hole	MD 1.43 (± 0.20)	98	
	TD 0.89 (± 0.20)		89
B) Unperforated (comparison)	MD 1.90 (± 0.27)	100	
	TD 0.70 (± 0.15)		100
Two 1mm holes	MD 1.63 (± 0.19)	86	
	TD 0.58 (± 0.10)		83
Two 0.5mm holes	MD 1.81 (± 0.19)	95	
	TD 0.64 (± 0.07)		91

TABLE 2

Film	Modulus
MD	
Unperforated	0.4552
	0.3565
	0.4195
One 0.5mm hole	0.4282
	0.3394
	0.3847
TD	
Unperforated	0.1228
One 0.5mm hole	0.0935
	0.1127
	0.0713
Two 0.5mm holes	0.1167
	0.0686

CLAIMS

1. A perforated collagen film for wrapping meat and poultry food products, the film comprising a series of perforations for allowing the escape of trapped air or steam from within the wrapped product, the pattern and the spacing of the perforations in each of two mutually perpendicular directions and the size of each perforation being such that the film has a strength sufficient for wrapping, processing and cooking the food product.

2. The film of claim 1 in which the perforations have diameters of less than 0.9mm.

3. The film of claim 2 in which the perforations have diameters of less than 0.7mm.

4. The film of claim 3 in which the perforations have diameters of less than 0.5mm.

5. The film of any preceding claim in which the perforations have diameters of at least 0.1mm.

6. The film of claim 5 in which the perforations have diameters of at least 0.2mm.

7. The film of any preceding claim wherein the perforations are arranged in a diamond pattern.

8. The film of any preceding claim in which each perforation is spaced 20 to 100mm from its closest neighbour.

9. The film of any preceding claim wherein the film thickness is between 0.017 and 0.028mm.

10. The film of any preceding claim in which the perforations are arranged such that the strength of the collagen film is reduced by not more than 30% in a specified direction.

11. The film of claim 10 in which the perforations are arranged such that the strength of the collagen film is reduced by not more than 20% in a specified direction.

12. The film of claim 11 in which the perforations are arranged such that the strength of the collagen film is reduced by not more than 10% in a specified direction.

13. The film of claim 12 in which the perforations are arranged such that the strength of the collagen film is reduced by not more than 5% in a specified direction.

14. A method of producing collagen film for use in wrapping meat and poultry products, the method comprising the steps:

providing a collagen gel;

extruding a film from the gel onto a surface;

drying the extruded film; and

perforating the dried film such that, in use, the film will allow escape of air from between the film and a meat or poultry product wrapped therein, and the strength of the film is maintained at a level sufficient to allow wrapping, processing and cooling of the food product without tearing.

15. The method of claim 14 in which the perforations are produced by needles.

16. A method of wrapping meat or poultry product, the method comprising the steps:

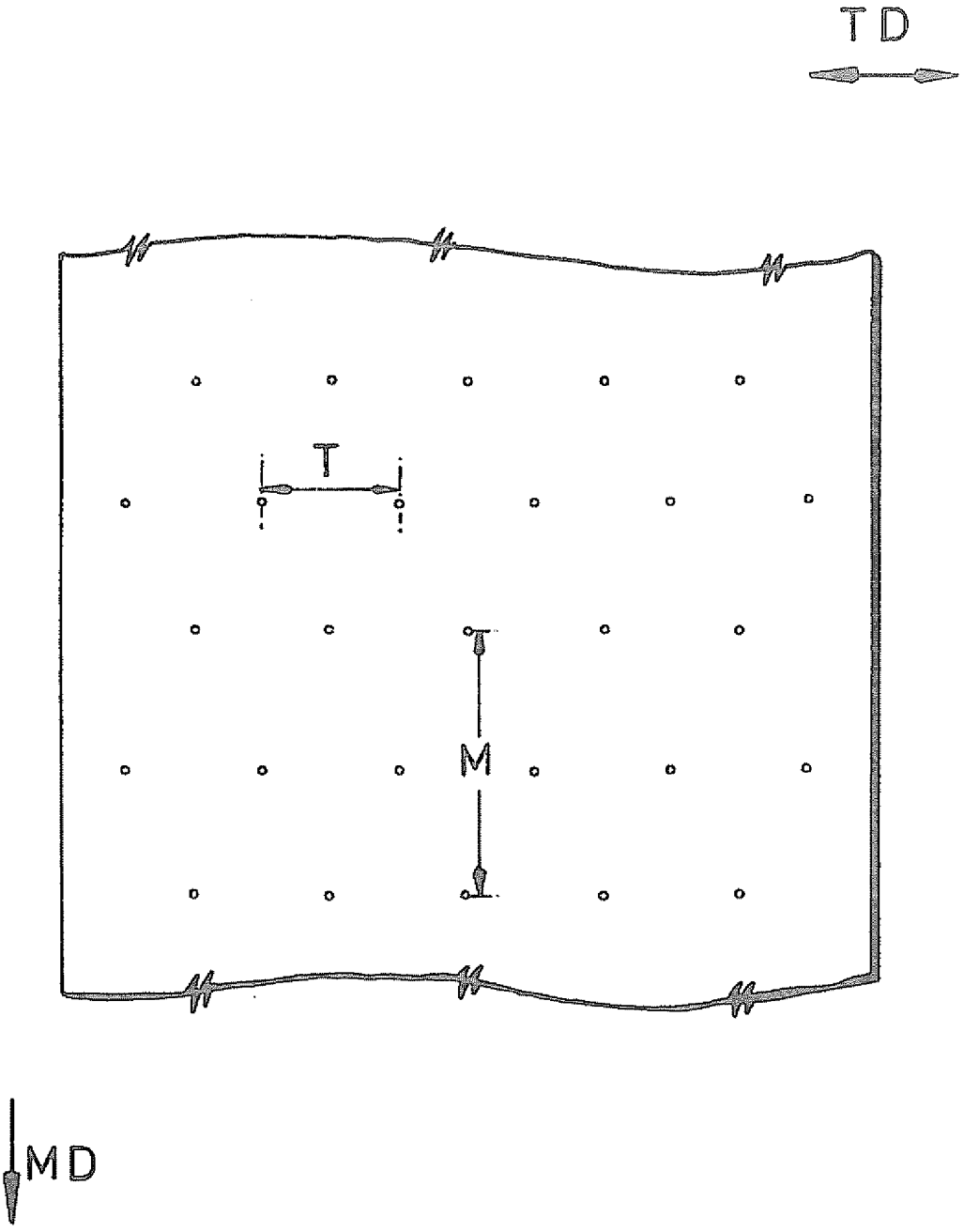
providing a perforated collagen film, the degree of perforation of the film being selected to allow the passage of air therethrough, but not so as to compromise the

strength of the film; and

wrapping the film around a meat or poultry product, any air trapped between said film and said product escaping through the film perforations.

17. The method of claim 16 in which the film-wrapped product is subsequently wrapped in an elastic net.

18. A cooked or uncooked filled netted product provided with a perforated collagen film wrapping as claimed in any of claims 1 to 13.


TD
T
M
MD

INTERNATIONAL SEARCH REPORT

International application No.
PCT/GB 94/01657

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 C08J5/18 B29D7/01 A22C13/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 C08J A22C C25D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US,A,4 657 548 (NICHOLS) 14 April 1987 see column 4, line 57 - column 5, line 11; example 3 ---	1-15
X	CH,A,662 543 (WIBERG) 15 October 1987 see page 2, right column, line 47 - line 52 see page 3, left column, line 2 ---	16-18
X	DATABASE WPI Week 8651, Derwent Publications Ltd., London, GB; AN 86-334861 & JP,A,61 249 366 (MATSUBE) 6 November 1986 see abstract --- -/--	1

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	FR,A,2 074 070 (BECKER ET AL.) 1 October 1971 see page 6, line 2 - line 15; claim 1	16-18
A	EP,A,0 070 940 (KUREHA KAGAKU KOGYO) 9 February 1983 see claims 1-6	1-18

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.
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Patent document cited in search report	Publication date	Patent family member(s)		Publication date
US-A-4657548	14-04-87	NONE		
CH-A-662543	15-10-87	NONE		
FR-A-2074070	01-10-71	DE-A-	1963798	24-06-71
		GB-A-	1335550	31-10-73
		US-A-	3813731	04-06-74
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		AU-A-	7902081	03-02-83
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		US-A-	4455206	19-06-84